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# Ludwik Karol Teichmann (1823–1895)

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**Abstract:** Ludwik Karol Teichmann was the last of gross anatomists. His magnificent work on the lymphatic system gained him appreciation of the whole current scientific world. Based on the unpublished materials authors wanted to commemorate one of the greatest Polish and world anatomists with special regard to coming soon 150th anniversary of Theatrum Anatomicum of Jagiellonian University Medical College.

**Key words:** anatomy, injection, lymphatic system, Theatrum Anatomicum.

Ludwik Karol Teichmann was born on the 16th of September 1823 in Lublin, son to Jakub and Tekla, maiden name Olszewska [1, 2]. In his early childhood he lost both his parents — his father's family took care of his upbringing. Raised by his aunts, often changing their dwelling, he became a pupil in Kraków, Kielce, Lublin, Radom and Warszawa, and since his early years he was earning extra money from tutoring. Due to the family traditions (his grandfather and uncle were both Evangelical Pastors), the talented Ludwik was destined for Theological Studies. In 1847, Ludwik Karol Teichmann, thanks to obtaining a scholarship from the Evangelical Consistory in Warszawa, moved to Dorpat, where he studied Evangelical Theology, dreary from his point of view. Involved in the affair of a formal duel as a second, fleeing

prosecution he leaves Dorpat, and through Hamburg he travels to Heidelberg. In 1850 he commenced studies at the Department of Philosophy at the University of Heidelberg, engrossed in the Natural Sciences: Chemistry, Physics and Technology. After a year of studying, he transferred to the School of Medicine [3, 4].

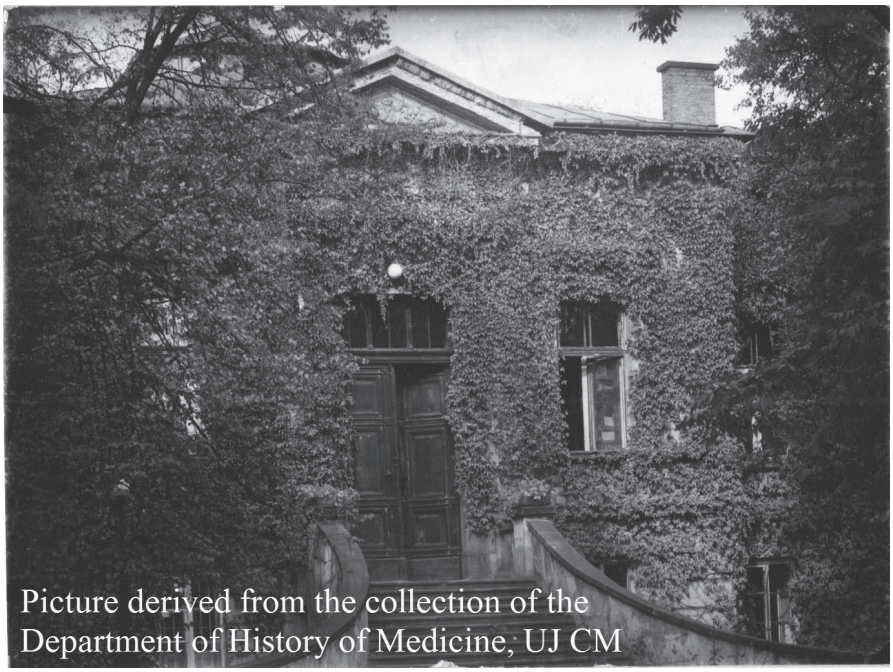



**Fig. 1.** Theatrum Anatomicum UJ CM, from before 1939.

Since the very beginning, Ludwik Karol Teichmann, an attentive student and a dexterous Prosector, attracts attention of Associate Professor of Anatomy Jakub Henle. Henceforth in 1852 Ludwik Teichman, following his Professor, departed to Göttingen, where Henle was given the Chair at the University and became his assistant. In the meantime, he published his first scientific research *"About the crystallization of the organic elements of blood,"* which serves as a method of identification of even the smallest traces of human blood in Forensic Medicine. The haemin crystals described by him are called "Teichmann's crystals" up to this day [5, 6].

Ludwik Karol Teichmann completed his Medical Degree on the 15$^{th}$ of December 1855, with the dissertation *"Zur Lehre von den Ganglien,"* obtaining a Ph.D. in Medicine, Surgery and Obstetrics with merit. The said work was published in 1856 and covers the problems of Pathological Anatomy of colloid cysts, found in the proximity of the extensor tendons, and their treatment. After the graduation, Ludwik Teichmann took up a position of provisional Prosector in Göttingen and held this post until

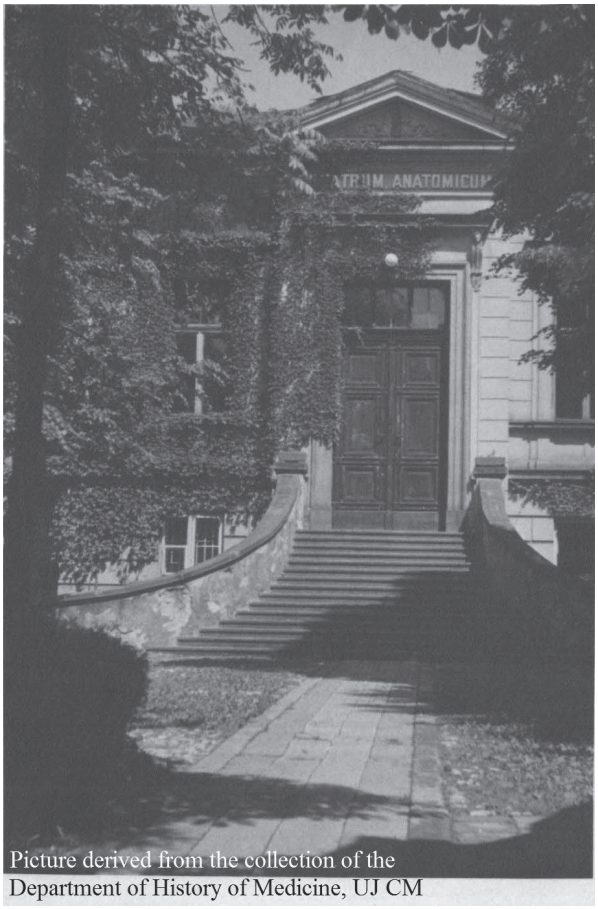



**Fig. 2.** Theatrum Anatomicum UJ CM, from before 1939.

1861. The years 1855–1861 were not only filled with the didactic work, but moreover he carried on studying and conducting scientific experiments. Since 1856, thanks to the Blumenbach's scholarship, Teichmann was able to visit numerous Departments of Anatomy throughout the Europe. In Vienna he met Professor Józef Hyrtl and since that time they became good friends [7]. Not only did Teichmann lead dissection classes with the medical students and anatomical microscopy seminars, but also he did not quit his own research regarding the injection of the lymphatic vessels [8–11].

In 1858, Teichmann attempted to become the Chairperson of the Department of Anatomy in Warszawa, but Prof. Ludwik Hirszfeld was elected instead. After rejecting the Chair at the Department of Physiology, he continued on working in Göttingen, where on the 24th of July 1859 he obtained *"veniam legendi"* in Anatomy and Physiology and became Private Associate Professor in the said areas. All the time he

carried on with his work on the lymphatic system, injecting the vessels and the lymph nodes, an arduous and intricate task that in his view supplemented the unsatisfactory and contradictory concepts of the lymphatic system. His epoch-making observations Teichmann presented in 1861 in the work titled: *"Das Saugadersystem vom anatomischen Standpunkte, bearbeitet von Dr Ludwig Teichmann, provis. Prosector and Privatdocent der Anatomie in Göttingen, mit 18 Kupfertafeln, Leipzig, W. Engelmann, 1816.XII.124."* [12] Not only did it represent the lymphatic system from the anatomical perspective, but it also considered the history of the investigations made in the field of lymphatic system, and was further divided into two volumes and *"the Appendix."* [13]

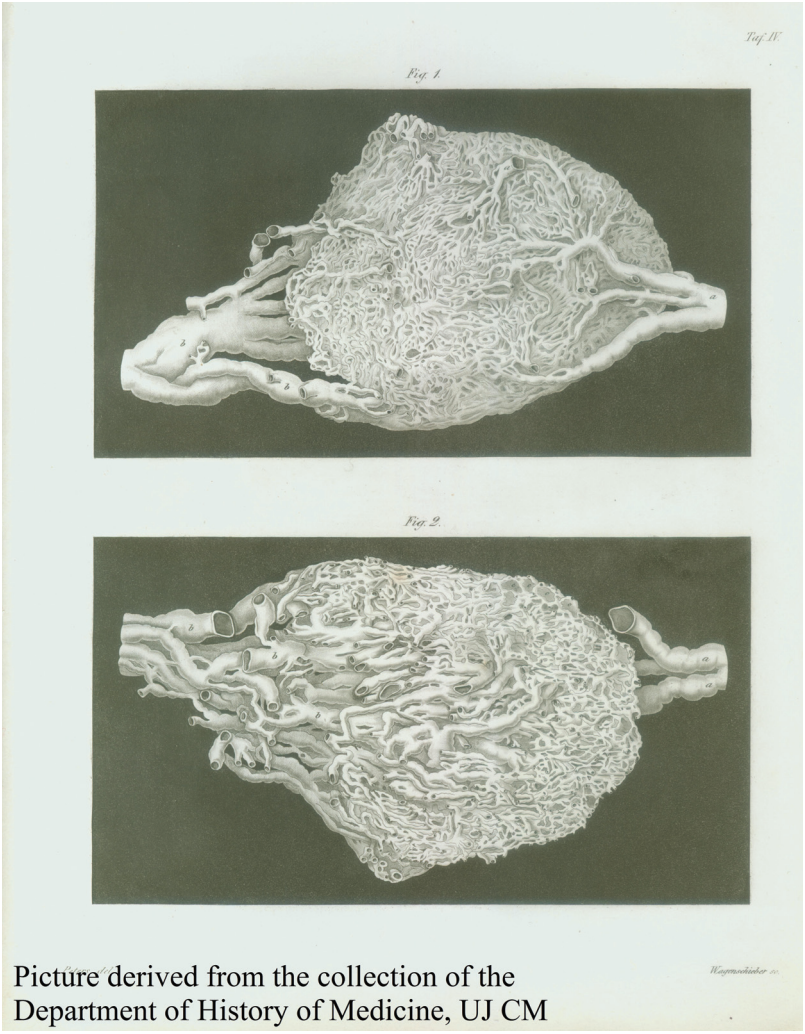



**Fig. 3.** The artwork of Teichmann's specimens in "Das Saugadersystem".

The first volume begins with the invocation, addressed to the friend of Teichmann's — Józef Hyrtl, Professor of Anatomy in Vienna. Then in the introduction, Teichmann substantiates the advisability of the described research. In the subsequent chapters of the first volume, he presents the results regarding the beginning of the lymphatic vessels and carries on depicting their nets, and glands and lymphatic bodies on their end. In the second part of the monograph titled: *"The lymphatic vessels of particular organs,"* Teichmann shows, in the cutting-edge way, the lymphatic system of the skin, conjunctiva, the respiratory system (trachea and bronchi), the digestive system (oesophagus, small and large intestines), liver and spleen. In the third part, *"the Appendix,"* the author distinguished three chapters.

The first chapter of *"the Appendix"*: *"The organs which lymphatic vessels were only partially researched,"* in which he describes his results regarding kidneys, urinary bladder, ureters, testes, striated muscles, heart and articulations. The second, *"About the passage of solids through the mucosa"* summarizes the experiments in which he probed the crossing of carbon powder, dye, starch and other small compounds from the intestines to the blood. He concludes that it is only possible after the disruption to the continuity of the mucosal and the blood vessel or lacteal walls. The final, third chapter of *"the Appendix,"* is definitely more comprehensive and titled *"The procedures of the injections,"* in which Teichmann describes the methods of injecting the lymphatic vessels, especially with his own injection masses. After publishing this study, Ludwik Teichmann, unappreciated up to this point for his work, became famous and his exemplary specimens gained him respect in the whole anatomical world [14–19].

In 1861, when the more apparent conflict with Prof. Henle did not allow him a longer stay in Göttingen, Ludwik Teichmann travelled to Kraków to become the Chairperson of the Department of Pathological Anatomy at the Jagiellonian University [20]. He was not at ease with the whole situation and disappointed with the hard conditions in which he was forced to work, hence he attempted to return to Germany, the wellspring of scientific progress and medical knowledge. However, in 1866 Teichmann did not receive the Chair of the Pathological Anatomy in Heidelberg and continued on working in Kraków, where he was gaining greater respect and credit as the days went by. In 1862 he married Anne Loebenstein, the daughter of the citizen of Kraków and settled down on Floriańska street. In 1868, following the retirement of Prof. Antoni Kozubowski, he received the Chair of the Department of Descriptive Anatomy at the Jagiellonian University, the field very much in his interest. As he wrote: *"I eagerly accepted the offer of the Faculty, with one caveat: that a congruent place for the Department of Anatomy has to be made, this I regard as urgent and crucial, a fact that must follow if studying Anatomy is not to be solely illusive."* In the meantime, the Austrian government provided Teichmann with a subsidy for the new building of the Department. After purchasing the grounds in Wesoła district, outside the city, the competition for the construction of the edifice

was written down. In the autumn of 1869, the foundations of this modern building were laid out and the whole object at Kopernika street number 12 was finished in 1871 [21]. At the time the Department of Anatomy was state-of-the-art among the other Departments in Europe. It was comprised of a ground and first floor, a large lecture hall with central heating, all planned by Prof. Teichmann. The Anatomical Museum was also established in a set of 4 rooms. Scanty specimens from St. Anne's street were moved there, and all the subsequent ones were made by Prof. Teichmann and his collaborators. On the first floor, there were also offices: the professor's, the lecturers' and convenient dissection rooms. On the ground floor a cadaver storeroom was decided on, alongside flats for two lecturers and two servants. The approval Teichmann was met by, the chance for improving workers labour conditions, and first and foremost his family, bind the Professor with Kraków. In 1872 he was chosen the Dean of the Faculty of Medicine at the Jagiellonian University. As an active member of "Krakowska Akademia Umiejętności" and Chairperson of the Faculty of Natural Sciences, in 1872 in recognition of his contributions to the development of science he was chosen as the Vice-Chair of the Academy and held this distinct position for many years. In the meantime he was appreciated by the Austrian government and became "the Governing Consultor." [22–24]

The years spent in Kraków were filled with Prof. Teichmann's active participation in the life of many scientific societies. In 1862 he published an article *"The lymphatic vessels in the newly inflammated tissue"* in "Przegląd Lekarski." The appropriately injected specimens were presented in "Krakowskie Towarzystwo Naukowe." In 1862 in "Tygodnik Lekarski," he published yet another research regarding the lymphatic system, titled: *"Lymphatic vessels in the connective tissue in pathological exsudations."* In 1864, Teichmann submitted a work *"Anatomical studies regarding the matter of heart muscle cells' volume"* in "Rocznik Towarzystwa Naukowego Krakowskiego." In 1867 in Paris, he took part in the international anatomical exposition, where he showed a child's skull with deciduous teeth and tooth crowns of the permanent teeth removed by chisel, as well as an adult's skull with visible structures of the inner ear, animal skulls cut in various sections, specimens of the thoracic duct and a copy of his study on the lymphatic system. The featured specimens were met with great appreciation by the anatomical world and Prof. Teichmann was rewarded with the French bronze medal, and subsequently "the Franciszek Józef's Order," presented to him by the Austrian Government. He had yet another successes while participating in an exposition in Vienna in 1873, where he showed some of the newly made specimens, i.e. lymphatic vessels of human lungs, multiple brains and a craniometer of his own invention. In 1890 he exhibited his specimens of injections to the human lymphatic system in Berlin [25].

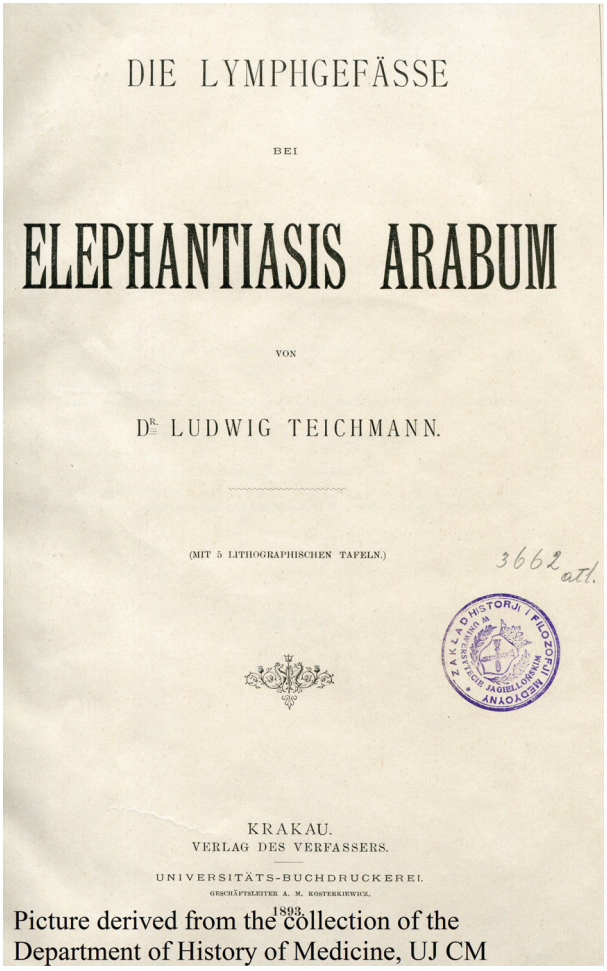
Although Prof. Teichmann was greatly involved in construction of the Theatrum Anatomicum in Kraków, he did not cease to study the lymphatic system further,

especially the unfinished research from 1861. In 1870 in the "Przegląd Lekarski" he published the work: *"Anatomical research in the topic of laryngeal lymphatic system,"* which served as an introduction to the subsequent articles published in 1871 titled: *"A few words about the value of the newer research of lymphatic system commonness, as well as lymphatic vessels of the larynx."* He described there the lymphatic vessels of the submucosal and mucosal membranes of the larynx and tried to systematize the anatomical terminology of the lymphatic system. The second publication, written down in German: *"Die Lympfgefaesse des Kehlkopes"* is a chapter in Hubert Lushki's book. In 1875 during "Zjazd Lekarzy i Przyrodników" in Lviv he presented a paper *"On the constriction and dilation of the lymphatic vessels from the Pathological Anatomy's perspective,"* in which he pointed out the problem relating ulcerated varicose veins of the lower limb healing process with the number of lymphatic vessels present there. The research is one of the many examples of how important — for both Anatomists and Pathological Anatomists — was Prof. Teichmann and clinical implications of his studies. The professor's work and his extraordinary scrupulousness while carrying out the research, were appreciated by the Jagiellonian University's academic community. In 1877 Prof. Teichmann was elected as the Rector of the Jagiellonian University.

Further anatomical studies and chemical experience gained during the first years of Teichmann's academic career, served him well in further improvements to his injection masses used in preparation for his next specimens. The search bore fruits in the form of establishing the chemical components of the injection mass. Its modification and technical methods of production, as well as use in injection of the lymphatic vessels and veins and arteries were presented in two publications. One of them was a short note in German from 1879, called: *"Ueber die Gebrauchswiese des Glasserkittes zur Injection der Blutgefaesse und anderer Kanaele."* [26–28] In 1880 in "Rozprawy i sprawozdania Wydziału Matematyczno-Przyrodniczego w Krakowie," he published a broad 50 pages long work called *"Lute as an injection mass and the ways of injecting it."* The news about the publications spread throughout the whole anatomical world, bringing Professor Teichman to even higher academic stature. Numerous European Anatomists were arriving to Kraków in order to get acquainted with the new method and to admire the tremendous specimens in the Department's Museum. One of them was a Professor of Anatomy from Basel — Julis Kollman, who after paying a visit to the Department of Anatomy at the Jagiellonian University wrote: *"I do not hesitate, after my own experience, to praise the advantages of this mass"* and *"Teichmann, with the invention of cold mass, did Anatomy a huge favour."* These words are the most suitable to summarise Prof. Teichmann's discoveries. Other Professors of Anatomy, i.e. Waldeyer and Schwalbe from Strasbourg, Hyrtl from Vienna, Wagner from Charkov, Ruber from Dorpat, were corresponding with Ludwik Teichmann, that enabled them to implement injection methods in their own Departments. Some such as Prof. Waldeyer, were even ordering syringes from Kraków for use with Teichmann's mass.

Due to the ongoing appreciation his contributions drew from the world of science and his students, in 1886 Ludwik Teichmann held the 25th anniversary of his scientific work. Thanks to the students' initiative and funding, a one-to-one scale bust of the Professor was made from terracotta by the sculptor Tadeusz Błotnicki. It adorned the lecture hall of the Theatrum Anatomicum. Up to this day one is able to admire it in the main hall of the Department of Anatomy at the Jagiellonian University in Kraków.

In 1886 in "Gazeta Lekarska" in Warszawa, and a year after in "Zeitschrift fuer Ohrenheilkunde," Prof. Teichmann published the work "*Three cases of anomalies that caused deafness*," in which he described the inappropriately developed auditory ossicles and lack of the external auditory canal he had discovered while dissecting the temporal bones. In 1887 in German "Anatomischer Anzeiger," he published


DIE LYMPHGEFÄSSE

BEI

ELEPHANTIASIS ARABUM

VON

Dr LUDWIG TEICHMANN.

(MIT 5 LITHOGRAPHISCHEN TAFELN.)

3662 atl.

KRAKAU.
VERLAG DES VERFASSERS.

UNIVERSITÄTS-BUCHDRUCKEREI.
GESCHÄFTSLEITER A. M. KOSTKIEWICZ.

1893

Picture derived from the collection of the Department of History of Medicine, UJ CM

**Fig. 4.** The front page of Teichmann's work on Elephantiasis.

a significant work called: *"About maceration of bones based on own experience."* Due to feeling the importance of preparing even more exemplary specimens for the scientific and didactic work, as well as museum exhibits, for which other Anatomical Museums in the whole Europe were waiting, for many years Prof. Teichmann improved the methods of maceration, injection and preservation of the soft parts. In 1892 he printed yet another work called *"About conservation of brain with spirit and turpentine oil."* Single specimens obtained by Teichmann via this method are shown in the Museum of Anatomy in Kraków up to this day [28–30].

While taking care of preservation techniques, Teichmann did not neglect the main field of his perennial research — the lymphatic system. In 1892 in "Rozprawy Akademii Umiejętności w Krakowie," he presented a report in German: *"Lymphatic*


**Fig. 5.** Illustration from Teichmann's work on Elephantiasis.

*Vessels in elephantiasis,"* which a year later he described more expansively in the work redacted with his own printing and enriched with noteworthy artwork, titled: *"Die Lymphgefaessebei Elephantiasis Arabum."* It is an introduction to a bigger monogram *"A peg to hang the Pathological Anatomy of the lymphatic system on,"* in which he depicted variations in the structure of the capillary lymphatic vessels and bigger lymphatic trunks, their dilation, valve failure, changes in connective tissue and oedema formation, as well as enlargement of the parts of the body taken up by elephantiasis. The conclusions presented by Prof. Teichmann show the anatomical basis for the clinically described variations. In 1893 Ludwik Teichmann obtained yet another merit from the Austrian government — "the Iron Crown Order." [9, 31, 32]

In 1894 Prof. Ludwik Teichmann, during "Zjazd Przyrodników i Lekarzy" in Lviv, presented the paper: *"About general ratios in human brain,"* which subsequently, as a summary of his works carried in the field of the encephalon, was published in "Lwowski Przegląd Lekarski," a journal in the said city.

Moreover, in Lviv there was a national exposition at which Teichmann presented his specimens, both shown previously in Vienna, as well as ones newly injected with the injection masses and also some preserved in glycerin, spirit and turpentine. He left a vast part of it in Lviv with Professor Henryk Kadyia. However, the animal specimens were donated to the Dzieduszycki's Museum in Lviv. The exposition and Teichmann's specimens were said to leave a rather fantastic impression on visitors, and in "Kronika Uniwersytetu Jagiellońskiego" from 1894, it was written that *"Prof. Teichmann's anatomical specimens already endeared tribute at the exposition in Vienna in 1873, something not unordinary for this scientist, but this time also exhibited a whole range of specimens in the field of Human Anatomy and Comparative Anatomy that for the first time used far advanced technique and superb methods of preservation on miscellaneous anatomical objects by the exhibitor himself. In between the said specimens, one might also notice the exhibitor's famous craniometer which allows measures of the skull to be taken without disrupting it in any way."*

In 1894 after 30 years of work at the Jagiellonian University, Prof. Ludwik Karol Teichmann retired and obtained the title of the "Court's Counselor." Not only was he appreciated by the university's authorities as a splendid scientist, but also as the creator and mastermind of the modern Department of Anatomy, as well as a prominent academic teacher. It was at the valedictory ceremony that Ludwik Teichmann said the illustrious words: *"I am excused from the duties imposed unto me by the law, but in momentous scientific work no one can make me redundant, and in this matter we will always remain inseparable."*

On the 25th of November 1895, defeated by a tough disease — pharyngeal cancer, Prof. Ludwik Karol Teichmann passed away in Kraków and was buried in the familial sepulchre at the Rakowicki Cemetery. In journal "Przegląd Krakowski" from the 2nd of December 1895, it was written as follows: *"The whole Kraków took part in this*

*funeral of a faded humility.*" The year after, Professor of Anatomy in Paris — F. Lejars reminisced: "*For people like Teichmann, there are no borders — they belong to the humanity.*"


**Fig. 6.** Professor Ludwik Karol Teichmann.

Lejars points to Teichmann's early interest in the lymphatic system dating as long ago as the end of 1850s, when he stayed with Henle. "*From this moment he commenced intense research on the lymphatic system. Then he instigated a series of experimental searches on the topic of injections to the blood vessels, obtaining exquisite and admirable results. Substantial part of the artwork boards, adorning the anatomical tractate of Henle, was developed based on Teichmann's specimens*" (p. 482) [11, 15, 33, 34].

"The anatomy of the lymphatic vessels remained the major area of interest throughout all of his scientific career. Teichmann was one of the first who injected and consistently reported the results obtained in this way while determining the topography of the lymphatic vessels in particular organs of the human body. His book from 1861, *Das Saungadersystem* is a proof of substantial advance in the history of research over the whole lymphatic vessel system." (p. 484)

*"I allow myself to affirm that throughout all these years of his work, the scholar, while creating the technique so different from others yet remaining in hiding, used first and foremost artistic abilities, as well as perfectionism in technical polishing of the necessary tools."* (p. 484)

*"In the field of anatomy, Teichmann remains the inimitable example."* (p. 486)


**Fig. 7.** Department of Anatomy UJ CM, from the 1970s.

## Conflict of interest

None declared.

## References

1. *Wachholz L.*: Ludwik Teichmann. Szkic biograficzno-historyczny. Archiwum Historii Medycyny. 1930; 10 (1): 34–62.
2. *Kohmann S.*: Ludwik Karol Teichmann (1823–1895). In: B. Skarżyński (ed.), Sześćsetlecie medycyny krakowskiej. Kraków 1963, Vol. I; 139–156.
3. *Sokołowska-Pituchowa J.*: Ludwik Karol Teichmann. Archiwum Historii Medycyny. 1968; 31 (3–4): 363–370.
4. Środka *A.*: Teichmann Ludwik Karol. In: Uczeni polscy XIX–XX stulecia. Warszawa 1998, Vol. IV; 356–359.
5. *Teichmann L.K.*: Lieber die Kristallisation der organischen Bestandteile des Bluts. Zeitschrift für rationelle Median (N.F.). 1853; 111: 375–388.
6. *Rogalski T.*: Prace największego polskiego anatoma na tle dawniejszych i współczesnych mu osiągnięć w zakresie wiedzy morfologicznej. Archiwum Historii Medycyny. 1957; 20 (1–2): 45–126.
7. *Hyrtl J.*: Handbuch der praktischen Zergliederungskunst als Anleitung zu den Sectionsübungen und zur Ausarbeitung Anatomischer Präparate. Wien 1860; 610.
8. *Cole F.J.*: The History of Anatomical Injections. In: H. Singer (ed.), Studies in the History and Method of Science. Oxford 1921; 288.
9. *Teichmann L.*: Naczynia limfatyczne w słoniowaciźnie (Elephantiasis Arabum). Kraków 1892.
10. *Teichmann L.*: Die Lymphgefässe bei Elephantiasis Arabum. Krakau 1893.
11. *Lejers F.*: Un grande anatomiste polonais: Ludwik Teichmann. Revue Scientifique (Revue rose). 1896 Ser. 4, 5 (16): 481–487.
12. *Teichmann L.K.*: Das Saugadersystem vom anatomischen Standpunkte. Leipzig 1861; IX.
13. *Teichmann L.*: Kilka słów o wartości niektórych nowszych badań chłonic w powszechności tudzież w naczyniach limfatycznych krtani. Rocznik Cesarsko-Królewskiego Towarzystwa Naukowego Krakowskiego. Kraków 1871; 62 (19): 28922.
14. *Sokołowska-Pituchowa J.*: Niektóre metody badań anatomicznych Teichmanna. Fol Morphol. 1969 (2): 173–177.
15. *Lejers F.*: La masse de Teichmann exposse d'après le momoire et le memoire et les enseigements de l'auteur. Paris: G. Steinheil, 1888.
16. *Teichmann L.K.*: Kit jako masa iniekcyjna i sposób nastrzykiwania tą masą. Kraków 1880.
17. *Teichmann L.K.*: O nowo przez siebie wynalezionym sposobie użycia kitu szklarskiego do nastrzykiwania naczyń krwionośnych, Rozprawy i sprawozdania z posiedzeń Wydziału Matematyczno-Przyrodniczego AU. 1880; XLI–XLIII.
18. *Kuś J.*: Historia metod iniekcyjnych w naukach morfologicznych. Fol Morphol. 1969: 147–160.
19. *Walocha J., Miodoński A.J., Nowogrodzka-Zagórska M., Kuciel R., Gorczyca J.*: Application of a mixture of glycol polyethylenes for the preparation of microcorrosion casts — an observation. Fol Morphol. 2002: 313–316.
20. *Robinson V.*: The Life of Jacob Henle. New York 1921.
21. *Gajda Z.*: O ulicy Kopernika w szczególności, o Wesołej w ogólności prawie wszystko, Kraków 2005: 18.
22. *Konopka S.*: Polska bibliografia lekarska dziewiętnastego wieku (1801–1900). Warszawa 1982; Vol. 11: 48–50.
23. *Gryglewski R.W.*: Ludwik Karol Teichmann jako preparator. Kwartalnik Historii Nauki i Techniki. 2014; 59, 3: 37–66.
24. *Sokołowska-Pituchowa J.*: Rys historyczny badań układu chłonnego. Fol Morphol. 1969: 161–170.
25. *Sokołowska-Pituchowa J.*: Ludwik Karol Teichmann. Archiwum Historii Medycyny. 1968 (3–4): 367.
26. *Walocha J., Skrzat J., Klimek-Piotrowska W., Zawiliński J., Mizia E., Goncerz G., Gorczyca J.*: Professor Janina Sokołowska-Pituchowa — a legend in Polish anatomy (1915–2011). Fol Morphol. 2012; 71: 56.

27. *Kowalczykowa J.*: Nieznana praca Ludwika Teichmanna o nastrzykiwaniu włosów. Patol Pol. 1954: 31–33.
28. *Walocha J., Litwin J.A., Miodoński A.J.*: Corrosion casting technique. In: H. Schatten (ed.), Scanning Electron Microscopy for the Life Sciences. Cambridge 2013; 17.
29. *Adamkiewicz W.*: Die Blutgefässe des menschlichen Rückenmarkes. Die Gefässe der Rückenmarkssubstanz. und II Theil. Sitzb Akad Wiss. 1881 (84): 469–502; 1882 (85): 101–130.
30. *Teichmann L.*: O mózgu ludzkim. Pamiętnik VII Zjazdu Lekarzy i Przyrodników Polskich. Lwów 1895: 7–9.
31. *Sokołowska-Pituch J., Walocha J.A., Skrzat J., Mazur M., Gziut T.*: In memory of Professor Józef Markowski, an anatomist from Lviv. Fol Morphol. 2007; 66: 360–364.
32. *Teichmann L.*: Über Knochenmaceracion nach eigenen Erfahrungen. Anatomischer Anzeiger. 1887; 2 (14): 461–468; 2 (15): 495–502.
33. *Waldeyer H.W.*: Hyrtl Joseph. In: Biographischen Lexikon der hervorragenden Ärzte aller Zeiten und Völker. München–Berlin 1962, Vol. III; 361–362.
34. *Gryglewski R.W.*: Zarys dziejów technik iniekcyjnych w preparatoryce anatomicznej. Pamiętnik XIII Sympozjum Historii Farmacji, Horyniec-Zdrój. 2004: 53–58.